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ABSTRACT

This "fastback" outlines the steps to take in computerizing school administration. After an introduction that lists the potential benefits of microcomputers in administrative offices, the booklet begins by delineating a three-step process for establishing an administrative computer system: (1) creating a district-level committee of administrators, counselors, librarians, special education teachers, at least one computer expert, and other end-users to identify school administrative functions best suited for computerization; (2) to locate appropriate computer software to accomplish the administrative tasks that have been identified; and (3) to select the hardware that will run the software that has been chosen. The second chapter, selecting software, discusses stand-alone versus integrated programs, disk operating systems, word processing, database management, spreadsheets, accounting, data analysis and graphics, and special applications. The third chapter, selecting hardware, discusses 8-bit machines, 16-bit machines, computer power, peripheral devices, and vendors. The final chapter addresses the problem of getting started and discusses consultants, establishing priorities, staff training, and the logistics of transferring to a computerized system. (TE)

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Using Microcomputers in School Administration

Eugene T. Connors,
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Using Microcomputers in School Administration

by
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Introduction

Managing schools is a complex job, requiring the processing of vast amounts of data. With new microcomputer technology, many school administrative tasks can be accomplished easily in less time, for less money, and with less administrative involvement than ever before. Such time-consuming administrative tasks as scheduling, report cards, attendance, records, discipline files, and health records can be computerized. Such accounting practices as general ledger, payroll, budgeting, student activity accounts, accounts payable, and accounts receivable operate much more efficiently with fewer mistakes when done with the aid of a microcomputer. Routine office correspondence can be accomplished faster and without errors. By using integrated software, it is easy to send personalized letters to parents of every pupil who has missed more than 10 days of school. To save energy and money, the school's energy modules can be monitored and shut down when not used.

One of the most important benefits of computerizing school administrative functions is that decisions can be based on more complete and more recent data, helping administrators to make more informed and timely decisions in a variety of areas. Computers, unlike humans, can easily access large quantities of information. Humans, unlike computers, can make value judgments based on large quantities of information. Once administrators learn to access these data from the

computer, they can use their time for more tasks requiring judgment and critical thinking.

Computers even can alter the personnel structure of a school. A good microcomputer system with appropriate software can do more work than previously performed by a staff of several secretaries and clerks. Since the microcomputer simply makes secretaries and clerks more efficient and productive, fewer office workers are needed. Indeed, two secretaries with good microcomputer skills can easily run a high school of 1,500 pupils without additional clerical help. Savings in secretarial personnel can be used to hire additional teachers, aides, study hall monitors, and other instructional support personnel.

Where to Begin

Too many school administrators buy a computer before they know enough about the computer or the programs it will run. Others buy programs for their computer and then try to adapt their school to fit these programs. Establishing an administrative computer system is a three-step process. The first step is creating a district-level committee of administrators, counselors, librarians, special education teachers, at least one computer expert, and other end-users (that is, secretaries, clerks, and business officials). This committee's role is to identify which school administrative functions are best suited for computerization. Many administrative tasks can be computerized easily, but a few are not appropriate for computerization. It is important to decide which tasks can be computerized easily and which cannot. If there is no district standardization, the building-level administrators should not wait to computerize. They should form similar committees at the building level.

The second step is to locate the appropriate computer programs to accomplish the administrative tasks that have been identified. In many ways, this may be the most difficult step. There are literally hundreds of computer programs that can be used in educational administration. Many are excellent programs that have been carefully planned and created, but there also are many programs that are trashy rip-offs. Before any program is purchased, one should review published evaluations and consult with current users of programs.

The third step is to select the hardware (the actual computer itself) that will run the software that has been chosen. Actually, this is perhaps the easiest step, because the needed software will determine the computer equipment to be purchased. One simply searches for the best buy from a reputable vendor who will supply good maintenance service and meet warranty requirements.

Selecting Software

One misconception is that all administrative tasks can be computerized easily. This is not true; there are many tasks that administrators perform daily that are done more easily without computers. For example, a small elementary school with 200 to 300 students would not benefit significantly, if at all, by computerizing daily attendance or scheduling. At the same time, there are a great many tasks that can be computerized easily and will reap large benefits in personnel time and effort, increased accuracy, and greater access to data. This chapter will discuss the six major categories of administrative tasks that should be considered for computerization: 1) word processing, 2) database applications, 3) spreadsheet applications, 4) accounting, 5) data analysis and graphics, and 6) special applications.

However, before discussing applications, let us first make a distinction between stand-alone and integrated programs and explain the principle of disk operating systems.

Stand-Alone Versus Integrated Programs

The stand-alone program is a software program written for a specific need. It many be a word-processing program, a database program, a spreadsheet program, or a graphics program. The program operates by itself and not in conjunction with other programs. There are

several advantages to stand-alone programs. Generally, they are more powerful than the similar module that might be found in an integrated package (not always, but generally). The main disadvantage of stand-alone programs is that they do not easily exchange data with other types of programs. Indeed, sometimes it is almost impossible to get the data out of one stand-alone program to use with another program.

The integrated software program usually consists of three to six "modules," which resemble several different types of stand-alone software packages. Usually, these integrated programs include word processing, spreadsheets, database, graphics, and communications modules. Some integrated programs contain modules with specific school applications, such as scheduling, attendance, and grade reporting. The advantages of an integrated software system are many. First, the price of the integrated software program is usually much less than one would pay for five or six similar stand-alone programs. Second, data created in one module can be accessed easily by another module. Some of these integrated software packages are so versatile and powerful that the administrator may not need to use anything other than one or two integrated programs for all administrative needs.

It is recommended that integrated programs be used rather than stand-alone programs if the modules of the integrated programs meet the needs of the school.

Disk Operating Systems

The computer programs known as the "disk operating systems" (DOS) convert other programs into a language the computer understands. DOS is a bridge between the program (for example, accounting, word processing, or database) and the hardware. DOS allows a program to be read by the computer from the diskette on which the program is kept, and it stores your data files on diskettes. A number of different disk operating systems are available, but usually only one or two will work on a particular brand of computer.

One of the most important functions of the DOS is to format storage diskettes. Formatting rearranges the metallic oxide particles on the plastic disk in such a way that a computer can recognize and use

the data. Usually, this is done on the diskette by creating tracks (like grooves in a record) and sectors (like pie-shaped divisions). Some operating systems format tracks and sectors on diskettes differently; therefore, not all operating systems can read data from the diskettes of other operating systems. All microcomputers use the same diskettes; but once the diskette is formatted, only a computer with the same type of operating system can use that particular diskette.

Some operating systems are much more sophisticated than others and, consequently, more difficult to learn to use and manage. Generally, the more sophisticated an operating system the more control a user has over the computer. For example, only sophisticated operating systems allow files to be password protected or encoded so that outside personnel cannot access information. On the other hand, most operating systems allow users to make back-up copies of whole disks or specific files on a disk and to delete files from a disk.

Features one should look for in selecting the appropriate operating systems for a computer are speed of operation and minimal use of memory. The operating system should interact with the computer user almost instantaneously. It also should use as little memory as possible in order to save the computer's memory for programs and data. Most computers have a limited amount of physical memory; the more memory required for an operating system, the less memory available for the program and the data.

Word Processing

Word processing, the most common use of the microcomputer, probably has the most immediate benefit for school administrators. Routine correspondence and reports are typed on the computer in much the same fashion as they would be typed on a typewriter. Once the document is in the computer's memory, it is easy to make alterations on the document, to move paragraphs, to delete and insert, to replace certain words with other words, and to change margins and other physical characteristics of the printed document. When the printed document requires editing, a secretary does not have to retype the entire document; the secretary simply retrieves the document from the com-

puter diskette and makes the editing changes only in those sections that need to be changed. One great advantage of word processing is that no new mistakes are retyped into the document. The only parts of the document that are changed are those where corrections are made.

There are hundreds of word-processing packages available, some very good and some very bad. Some cost around $500, some as little as $49. One major mistake that often is made when purchasing word-processing programs is the tendency to buy the most expensive program on the market. These programs run in the neighborhood of $300 to $500, and they certainly will do everything the producer claims they can do. However, these programs are so complex, it usually takes a highly experienced operator to use all their capabilities. First ask, do you really need a program with indexing and footnoting capabilities? If so, buy one; if not, then you can buy a cheaper program that is easier to use. Remember that it is mostly the secretaries and clerks in the school who will be using the word-processing programs. Keep in mind their capabilities, their attitudes toward computers, and their overall skills before selecting a very expensive but difficult to use program.

There are some basic features that should be included in any word-processing program selected for a school office. One is the automatic return at the end of each line; also the ability to adjust left and right margins is an important feature. Furthermore, it is important to select a program that displays the same format on the screen as will appear on the printed page. If the word processor is to be used for reports that include columns, then adjustable tabs are very important.

Almost all good word processors include insert/delete capabilities. Any good word processor should be able to perform these functions with one or two keystrokes. It also should be able to move a large block of text (two or three paragraphs) from one portion of the document to another.

There are sophisticated word-processing features to consider as well. For example, many word processors have extensive footnoting capabilities, allowing the user to type a footnote in the document follow-

ing the text to be noted, and the computer automatically adjusts the page so the footnote appears at the bottom. Other sophisticated features include headers that appear at the top of every page or every other page of text and footers such as a page number or a message at the bottom of every page. Some word processors also have indexing capabilities; the user marks items in the text that automatically are alphabetized and paginated in an index. In addition, some word processors have features that allow the user to construct a table of contents.

Spelling checkers are another very useful program that should be considered. Some word processors come with spelling checkers built in; others are compatible with separate stand-alone spelling checkers. Spelling checkers compare each word in the document against the words in their dictionaries to see if the words are spelled correctly. If the spelling checker does not match a word with one in the dictionary, it will indicate that the word may be misspelled. Some commercially produced spelling checkers allow words to be added to the dictionary, such as the name of the school and the principal, as well as a variety of technical terms that would not appear in a normal dictionary.

Features that users should look for in spelling checkers are the number of words in the dictionary (should have at least 70,000 words), the ability to add words to the dictionary or to create sub-dictionaries, and the ability of the program to show the misspelled words in context so the user can determine if a word is truly misspelled or if it is a term not listed in the dictionary. Speed is another consideration; a 15-page document should be able to be checked in three to four minutes.

Once the office staff becomes comfortable with the program, word processing will become the largest and most popular use of the microcomputer. It is also an excellent place to introduce the computer into the administrative setting.

Database Management

Computers can save the most time and energy when used for database management. The term "database" is synonymous with the term "file" and simply means a collection of information arranged in a

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specific manner. Examples of databases are: pupil records, personnel records, health records, student performance data, and student schedules. By entering such information into a computerized database management system, the information can be retrieved very quickly. Database programs can reorganize the data and select only those data that are needed by the user. The user also may create new information from existing information. The educational applications of databases are almost limitless.

All database management programs (henceforth referred to simply as databases) work in essentially the same fashion. A specific format for the information is predetermined by either the user (if the database program is a general database system) or the publisher of the program (if the program was designed for a specific use). For example, an administrator may purchase a general database to set up a student information file for last name, first name, student number, address, city, state, zip code, and parents' names. Each of the above categories is called a "field." Some programs allow the user to format the fields anywhere on the monitor's screen, while others use a column-and-row format with individual fields making up the column headings. Either system is satisfactory, although the row-and-column format does not allow for a flexible design.

Once the format has been determined, data are easily entered by a clerk, secretary, or student in much the same way as they would use a typewriter to type the same information on a preprinted form. When the data needs to be accessed, the user simply enters the appropriate retrieval information, such as a student number, and the information for that particular student will appear on the screen and may be printed out. The data in the file may be manipulated in a variety of ways. For example, mailing labels may be printed by zip code order for bulk mailings, or a list of students may be printed in alphabetical order or by order of student number.

There are essentially two kinds of databases of interest to school administrators: file management programs and relational database programs. The type of database used depends primarily on the particular uses the school has for the data and the skill levels of the personnel who will use the program.

File Management Programs. File management programs, or filing systems, are easy to learn and to use; but they are the least powerful databases. Although information may be retrieved and reports written in many ways, a filing system can work with only one file at a time and cannot use information in other files. For example, if a school has one file with student attendance data and a separate file with student grades, the number of absences a student has would have to be transferred manually onto the computerized report card to be sent home to the parents. The filing system would not have the capability to meet this particular need.

However, file management programs generally are easy to learn and use. Most are menu-driven programs providing the user with a list of options or selections, and the user simply presses a letter or number to indicate the function to be performed.

Relational Database Programs. Relational databases can access data in two or more files and can create new files out of other files. This capability of relational database programs can save enormous amounts of data entry time. But in spite of the flexibility offered by relational databases, they generally are very difficult programs to learn and use. Many relational databases are command-driven; that is, the user must direct the operations of the program by entering commands rather than simply selecting options from a menu. Some publishers have added menus to their relational database software to make them easier to use for the beginner; however, command structures still have to be mastered to use the full power of the database.

Spreadsheets

Spreadsheets essentially are computerized balance sheets composed of rows and columns. The intersections of rows and columns are called "cells" into which alphabetic characters, numbers, and formulae may be entered. In addition, most spreadsheets can automatically perform such mathematical and statistical calculations as arithmetic mean; sine, cosine, and tangent; square root; minimum and maximum values; algebraic logic; counts of the number in a list; and many others. Although the most common application of spreadsheets is for budgeting,

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they can be used for school inventory, teacher grade books, accounts receivable, and any other application requiring numbers and formulae. The number of applications for spreadsheets are left only to the creativity of the user.

Most spreadsheets are not difficult to master, and most work in a similar manner. Newer spreadsheets are almost all menu-driven rather than command-driven, but either type is rather easy to use. The main difference in spreadsheets is the number of rows and columns that they allow (from 255 X 63 to 85,000 X 85,000) and the number of different built-in functions performed.

Accounting

Computerized accounting systems have a great number of advantages and almost no disadvantages. Manual accounting systems require a great deal of personnel time and provide many chances for human errors. Computerized accounting takes less time and results in fewer errors. External auditors appreciate microcomputer accounting because it makes auditing the school district's books easier and saves them time as well.

Accounting programs generally fall into five modules: general ledger, payroll, accounts receivable, accounts payable, and inventory control. Most school districts will use only the general ledger, payroll, and accounts payable modules (some small districts have found that accounts payable modules are more trouble than they are worth). Private schools also will use the accounts receivable module to invoice parents for tuition, etc. Most inventory modules available are used for either manufacturing inventory control or sales inventory control and thus would be inappropriate for most schools.

These programs can be purchased in stand-alone modules, which may not have the ability to trade data with other modules, or in integrated accounting programs. Integration is important for payroll in order to post automatically the appropriate amounts to the general ledger's payroll accounts. Integration also is important for accounts receivable. Most integrated systems and several of the better general ledger programs also contain check writing programs that will write

checks for the user. The computer generates a check register that already has been computed and balanced.

General Ledger. The general ledger is probably the most popular of the accounting packages. Most general ledgers use dual-entry accounting procedures; therefore, the user must have some knowledge of dual-entry accounting practices. Computerized general ledgers usually are highly sophisticated programs that have very specific hardware requirements. The choice of a general ledger program may determine the hardware that is purchased.

School administrators should make sure that the general ledger's account numbers are consistent with and large enough to accommodate the state's account codes. Some states use letters in their account codes, which poses a problem if the general ledger module cannot use letters. The ledger should be powerful enough to contain all of the state codes as well as additional ones that might be used at the local level. The ability to departmentalize accounting codes also is a must, with the program being able to handle three or four sublevels. Another nice feature to have in the general ledger is the ability to compare revenues and expenditures against budgeted figures. By examining the kinds of reports the general ledger generates, the administrator can determine whether they are sufficient for the board, state auditors, and others.

The general ledger should be a user-friendly system that is menu-driven and can be used by any school bookkeeper. It is recommended that individual schools and the central office use either the same or compatible general ledgers. In this way, each school can keep track of its expenses using the same account numbers as the central office. When it comes time for local school audits or creating reports for the state, data can be collected from the individual schools off their general ledger data disk, rather than each principal spending time to fill out reports manually. Before purchasing a general ledger package, school administrators should check with appropriate state department personnel. Many states are creating their own general ledger packages to help the schools manage their funds.

Payroll. While many school districts do not run their own payroll accounts, they can do so with microcomputer payroll programs. The

payroll program should have the capability to handle multiple deductions for such things as medical insurance, health insurance, state or other retirement, union dues, Christmas club, and one or two other miscellaneous deductions in addition to the required state and federal deductions. Data on hourly employees should have default values (40 hours) with the ability to manually override the defaults. And of course, any payroll program should be able to print complete reports for each pay period, with month-to-date, quarter-to-date, and year-to-date information. The program should have the capability to fill out W-2s at the end of the year and to print the payroll checks. Also, ensure that the payroll program is capable of handling all employees. Some payroll programs limit the number of employees to 150.

Data Analysis and Graphics

Data analysis and graphics programs have a variety of uses in education. Everything from scoring tests to presenting charts to the school board can be done with some of these programs. With such hardware as card readers and optical mark scanners, there is almost instantaneous feedback of student test scores to the teacher. With software for Individualized Education Programs (IEP), school districts can enter information about each handicapped child in order to monitor the child's progress and ensure that the goals and objectives in the IEP are being met on schedule.

One nice feature of many data-analysis programs is the ability to present professional quality graphics on computer screens, slides, overhead transparencies, or paper. Good programs can use existing data (from financial files, for instance) to create special graphics. Some programs print high-quality, black-and-white graphics, while others use special printers for color graphics. Professional quality slides can be created easily by a photograph from these graphics. When making presentations to civic groups, faculties, and the school board, such high-quality graphics are a plus.

Special Applications

In addition to general administrative applications, there are other special tasks that can be computerized. Scheduling, attendance, and

grade reporting often are accomplished more efficiently by a computer.

Scheduling Programs. Scheduling students in classes is one of the most onerous tasks of high school administrators. With the aid of the computer, this task no longer needs to be such a chore. Although starting a computer scheduling program requires a great deal of thought and time, it will save time in succeeding years when the process is completed. Most scheduling programs for microcomputers require entering the following data: student demographics, student course requests, a list of valid courses, teacher data including courses to be taught, and a list of rooms including any courses that require specific rooms. Although most microcomputer programs require the user to predesign the master schedule, there are a few that also will design the master schedule. Most programs will produce the following reports: section, teacher, and course lists; individual student schedules; student course requests; class lists; student schedule matrices for scheduled and nonscheduled students; and room-conflict matrices.

Determining which scheduling program a school uses will depend on a number of variables, but the primary consideration will be the amount of memory necessary to complete the scheduling process. The greater the number of students and courses that must be scheduled, the greater the amount of memory will be needed. Therefore, administrators must be very careful in selecting a scheduling program. Other capabilities of scheduling programs that administrators should consider are: compatibility with optical mark readers that will automatically read and enter student course requests, ease with which the data may be transferred to the next school year, and the technical assistance provided by the program's publisher.

Attendance Programs. Attendance programs make it possible to gather daily attendance data quickly and send absence lists to all teachers. In addition, attendance programs save large amounts of personnel time in preparing weekly, monthly, and yearly reports. Most attendance programs will provide the user with a variety of reports including entry/withdrawal; attendance register for any specified period; statistical matrices by month for any period, including statistics for average daily attendance, average daily membership, and percent

of attendance; and daily absence lists. The most important feature to consider when choosing an attendance program is whether the program meets the reporting requirements of the school district and state government. Many districts and states require that attendance be reported period by period, while others require only half-day attendance to be reported. Also, it is recommended that attendance programs be compatible with an optical mark reader so that daily student absence lists can be entered automatically, which greatly speeds the process and allows the secretary or clerk to perform other necessary early morning duties.

Grade Reporting. Grade reporting programs are invaluable for maintaining cumulative grades for students and for preparing report cards. One of the best features of computerized grade reporting programs is their ability to automatically calculate Carnegie units taken, units needed, grade point averages, and other such data. Most school grade reporting programs provide student report cards; class rankings; honor roll; enrollment data by instructor, student, and course; and course data.

Other Applications. There are numerous administrative tasks that can be accomplished more efficiently with computers. Three that deserve consideration are building management, library maintenance, and bus routing.

There are some excellent building management programs that monitor the school and alert security personnel when intruders are detected. These programs also can monitor such hazards as fire and wind damage and then notify the appropriate persons. In addition, building management programs can control heating and cooling systems and automatically shut down specific sections of a building at certain times of the day, thereby saving energy. Most building management programs are very expensive and require special hardware, but usually these programs pay for themselves in energy savings. New school buildings should be built with computerized energy management and security systems, but existing schools can be modified relatively inexpensively.

Library maintenance systems can replace the traditional card catalog and manual checkout process. There are programs available that

will maintain an inventory of books, audiovisual equipment, and other materials and will keep track of aquisitions. An advanced library system replaces the manual card catalog with computer terminals. However, a computerized catalog system is very expensive because the additional terminals must be networked to a central microcomputer with a memory large enough to include all the information in a traditional card catalog.

Using computers to route school buses also can save a lot of time and money. Transportation supervisors spend large amounts of time each year removing students from bus lists, adding new students and new stops, and then planning new bus routes through much of the district. There are several good programs available to computerize this process. The initial procedure of setting up the program is a tedious task that requires mapping each bus stop in the district into a grid pattern. However, once the set-up procedure has been completed, the computer program will provide the most efficient routes possible within the parameters provided. The user determines such parameters as the maximum number of students per bus and the longest time a student may ride on a bus. Subsequent re-routing will require only the deletion of stops and addition of new ones.

Selecting Hardware

Microcomputers come in three basic types: 8-bit machines, 16-bit machines, and 32-bit machines. The higher the bit power, the greater the potential of the microcomputer. The term "bit" refers to how the microcomputer handles data. Eight bits equals one byte, or one character of information. An 8-bit machine processes a single character of information at a time. The 16-bit machine is more than twice as powerful; it handles information anywhere from three to five times as fast.

The 16-bit computer is the generally accepted standard for most business software and hardware. Many of the comprehensive databases, spreadsheets, integrated programs, accounting programs, and other software written for business are designed for use in 16-bit machines. There also is a large number of 8-bit machines currently on the market, and many school districts have bought these computers for student use as well as for administrative applications. While 32-bit computers are available, school administrative software for these computers is limited. Therefore, the following discussion will address only 8-bit and 16-bit microcomputers.

8-Bit Machines

There are a variety of excellent and economical 8-bit computers to use for administrative functions. Most school administrators can afford to devote some uncommitted budget funds to purchase one for administrative purposes. An 8-bit computer system with a color mon-

itor, two floppy disk drives, and an 80-column printer costs about $1,500.

The advantages of 8-bit computers are their low cost and ready availability, and they are easily repaired and replaced. Also, because of the high number of 8-bit microcomputers currently on the market, manufacturers will continue to provide service and software despite the inroads of advanced technology. But 8-bit microcomputers are becoming obsolete, and little new administrative software is being developed for these machines. Also, most powerful administrative software does not run on 8-bit machines, and few integrated programs will run on them.

While 8-bit microcomputers have many limitations for administrative applications, they are excellent for curricular applications. Yet many principals seem to prefer compatibility of hardware throughout the school despite the fact that the administrative needs of a school vary greatly from the curricular needs of pupils.

While many schools have committed themselves to 8-bit microcomputer software for students, 8-bit microcomputers can meet the full administrative needs of only a small school. Schools with more than 500 pupils need a more powerful hardware configuration.

16-Bit Machines

The 16-bit machines outperform their 8-bit counterparts in memory capacity and the speed with which the programs operate. There are also many more administrative programs for the 16-bit computers than there are for 8-bit computers, and these programs are far more powerful.

One of the major considerations in the acquisition of a 16-bit computer is whether it is IBM-PC compatible. The PC compatible computer can run a great variety of software appropriate for education administration. In fact, most of the quality programs available for administration require a PC compatible machine.

Computer Power

In addition to the number of bits a computer can process at one time, there are a variety of other ways to measure the power of a

computer. The amount of memory, storage capacity, speed, and ability to perform multi-tasking operations (networking) are elements that need to be considered when purchasing hardware.

Memory. Microcomputers use memory to hold programs and data. This memory is referred to as RAM (Random Access Memory). The amount of RAM that a computer has determines the type of software it can use, how much data it can hold and manipulate, and how fast it performs operations. The size of the computer's memory is measured in thousands of bytes, commonly referred to as K. Computers usually have memory in increments of powers of 2: 16K, 64K, 128K, 256K, and so on.

How much memory should an administrative computer have? A rule of thumb is buy as much memory as possible. Memory is one of the cheapest aspects of a computer; and since the effectiveness of software frequently depends on how much RAM a computer processes, it makes sense to have as much as possible. Most powerful software requires at least 256K, and many programs use 528K. With the increased use of desktop software that resides in memory until you use it (desktop software usually contains such things as calculators, calendars, appointment books, telephone directories, spelling checkers, thesauruses, etc.), it is recommended that administrative computers possess 640K of RAM. If particularly powerful software is going to be used, expanded memory of up to eight megabytes may be considered (a megabyte equals one million bytes); but many programs will not use more than 640K of RAM.

Storage Capacity. Because a computer loses its RAM when it is turned off, there must be some way to store the programs and data. The most common storage medium used with microcomputers is the disk. There are two types of disks, the floppy disk and the hard disk.

Floppy disks are similar to a small phonograph record made of mylar plastic and are housed in a square plastic case. They are called floppy because they are flexible and can be bent easily. Floppy disks come in three sizes. Older computers use 8-inch disks, while most newer microcomputers use 5¼-inch disks. Some of the latest microcomputers use 3½-inch disks. With the advances in technology, the smaller disks actually hold more data than the larger (and older) floppies.

Hard-disk technology has made great advances in the last few years. The disk is made of hard plastic and sealed in a unit that usually is housed inside the computer so the user never actually sees the disk. Some computers use external hard-disk drives, which are located in a box outside of the computer and are connected to the computer with cables. Hard disks hold anywhere from 10 megabytes to 100 megabytes of data. Hard-disk units are available for almost any brand of 8-bit and 16-bit machine. There are two major advantages in using hard disks instead of floppies: hard disks hold much more data, and they access the data much faster than floppies do. However, every computer system will need at least one floppy disk drive regardless of whether it contains a hard drive. All software is supplied on floppy disks. If the computer has a hard drive, the user must copy the software from the floppy disk onto the hard disk.

For administrative purposes, it is highly recommended that a hard-disk drive be used. Even on a two-floppy system, the user will have to change disks many times when using powerful software, whereas on a hard-disk system, the user has all the software programs and data stored on one disk. Usually the floppy drive is used only to copy programs onto the hard disk or as a back-up copy in case of emergency. Administrative computer systems should have at least one floppy drive and a 20-megabyte hard drive.

Speed. Another consideration in measuring the power of a computer is its speed. As the database grows and the complexity of the programs increases, the speed of a computer becomes increasingly important. The average 16-bit computer runs at 4.77 megahertz (a megahertz equals one million cycles per second). Special "speed-up" boards can increase that speed to up to 8 megahertz, and some of the newer "AT" machines can operate as fast as 12 megahertz. Use a machine that operates at least at 4.7 megahertz and, if possible, get an 8 megahertz computer.

Networking. Computers with "multi-tasking" or "networking" capabilities allow more than one individual to use the computer at the same time by using a remote terminal. The advantages of this type of arrangement are many. While guidance personnel are updating pupil records, a secretary can type correspondence and a bookkeeper can

perform accounting functions all at the same time. However, computers that have multi-tasking capabilities must have large RAM (640K minimum), large storage (30 megabytes of hard-disk space minimum), an operating system that will allow simultaneous use of the computer (Unix or Xenix operating systems), and programs that are capable of networking (much more expensive than the non-network versions). The IBM-PC/AT compatible computers are much better suited for multi-user capabilities than most other computers. With the cost of computer systems declining, a viable alternative to networking would be the purchase of several less expensive, stand-alone computer systems that are compatible.

Other Considerations. Most computers allow the users to add a variety of peripheral hardware features by simply plugging a "card" into the computer. These add-on cards can perform many different types of functions. There are cards that add color capabilities, telephone modems, exanded memory, more speed (accelerator cards), extra serial and parallel ports (for connecting to printers and external devices), and game or mouse ports, as well as other functions. If the computer will be used to perform a lot of complex mathematical operations, installing a 8087 math co-processor chip is highly recommended. This chip helps the computer do arithmetic operations much faster.

Peripheral Devices

There are many peripheral devices that can be connected to computers to increase their usefulness. Some peripherals such as monitors and printers are essential; others such as different types of keyboards, print buffers, back-up tape drives, and telephone modems can increase the utility of the entire computer system.

Monitors. A computer must have a monitor for the user to view what is happening. Computer monitors come in three types: monochrome, RGB color, and enhanced color. Almost all software will work on a monochrome (single color) monitor. Monochrome monitors display characters and images in green, amber, blue, or white. Green and amber monitors are the most common. There does not appear to be any advantage is using green or amber other than the user's personal preference.

Color monitors will display multiple colored characters and images (usually 16 colors). While the use of a color monitor is not a necessity, it is recommended. Many programs use color capabilities in highly creative and useful ways. Different menus utilize different colors to help the user maintain awareness of program location. RGB color monitors (Red, Green, Blue) cost between $350 and $500, while monochrome monitors cost around $150.

Printers and Plotters. An administrative computer system requires some type of printer to print reports, letters, financial journals, etc. Of all the peripherals that can be attached to a computer, there are more choices available for printers than for any other type of hardware. Generally, there are six types of printers: dot-matrix, daisy wheel, laser, thermal, ink jet, and plotters. Thermal printers and plotters are not recommended for administrative computers.

The most common printer is the dot-matrix printer. This type of printer makes characters by using a pattern of dots. Early dot-matrix printers were only capable of forming crude characters and were not considered to be of high enough quality to use in business. However, dot-matrix technology has progressed considerably in the last four or five years; and the new dot-matrix printers form excellent characters. While the quality is not as good as a typewriter, the quality is still quite acceptable for almost all business and administrative applications. Many of the newer dot-matrix printers have extensive printing capabilities. Multiple fonts, special print features (bold, enhanced, italics, double size, compressed characters, underlining, super- and sub-script characters), and graphics are becoming standard. Dot-matrix printers tend to be faster than most other types of printers.

Dot-matrix printers come in two sizes: narrow carriage (80 columns wide) and wide carriage (132 columns wide). For administrative purposes, it is recommended that a wide-carriage printer be used. Many financial programs require wide printers, and spreadsheet programs are almost useless without one. Wide-carriage dot-matrix printers cost from $500 to $2,000 depending on the quality of the print and the multiple fonts that are available. For most administrative tasks, a $750 dot-matrix printer will work quite nicely.

The second type of printer is commonly called the "daisy wheel" or "letter quality" printer. These printers operate much like a typewriter. They have a typing element (daisy wheel) that actually strikes the paper, thus giving typewriter-quality characters. Daisy wheel printers provide the highest quality type of all the printers and are a good choice where quality print is important. However, they have several disadvantages. They tend to be very noisy, and many users end up purchasing special housing units to reduce the noise level. And they are very slow. It takes a daisy wheel printer about 2 minutes to print a page of text, while a dot-matrix printer can do it in about 20 seconds. Daisy wheel printers cost between $500 and $1,500.

A new type of printer that has been recently developed is the laser printer. These printers use a technology similar to duplicating machines. Laser printers are expensive (beginning at $3,500) but provide excellent type quality and beautiful graphic capabilities. Laser printers often are used as an alternative to typesetting. Schools could easily produce high quality newsletters, newspapers, and yearbooks with one of these printers. While it is not necessary for each school in a district to own a laser printer, it would be nice if each school had access to one for high quality printing needs.

Ink-jet printers spray a fine mist of ink onto the paper to create images and characters. These printers are particularly useful when multiple colors are needed. Ink-jet printers have a broad price range depending on color capabilities and print quality (from $200 to $1,500). These printers are appropriate for administrative applications and provide an alternative to the dot-matrix printer.

Print buffer. When a computer is printing a long document or report, it cannot perform other functions. One way to free up the computer is to send the document to a print buffer, which holds the document in its own memory and drives the printer. The computer thinks that it has finished printing and is ready to do something else. A 64K print buffer will hold about 32 pages of text in its memory and costs about $200.

Modems. A telephone modem attaches a computer to a telephone line to enable the user to communicate with other computers. Some desktop software also will allow the user to select a telephone num-

ber from the telephone directory and automatically dial the selected telephone number. The ability to share data with a computer at another location has many useful applications. For example, moving pupil records from the middle school to the high school via a telephone line saves an enormous amount of time. However, there is one caveat: regardless of the levels of security and use of passwords, sooner or later some student using a $200 computer will "hack" into your system and wreak havoc with your data. Therefore, instead of transferring data with a modem, administrators should transfer the data onto a floppy disk and deliver it by hand to the other location. While this recommended procedure is more trouble than using a telephone modem, it will protect the school's data from ambitious hackers.

Other Peripherals. There are a variety of other devices that can be attached to a microcomputer system. One of the most useful of these is a "mouse." A mouse is a small box-like device that is attached to the computer. As the user slides the mouse over the surface of the table, the cursor (the input symbol on the computer's screen) moves in a similar direction and manner. Basically, the mouse enables the user to move the cursor without using the direction (arrow) keys on the keyboard. A mouse for a PC compatible computer system costs about $150.

Many schools have found an optical mark reader (OMR) or card reader to be a wise investment for their administrative computer systems. These devices read paper sheets that are encoded with information. The use of the "bubble" sheets (paper with dots, or "bubbles," that are filled in with a No. 2 pencil) is a very efficient way to input large quantities of data. Such scanning devices can aid administrators in an assortment of tasks ranging from pupil attendance to correcting standardized tests in-house.

Vendors

One of the most commonly asked questions is, "What kind of computer should I buy?" The type of computer system to purchase depends on what types of administrative tasks it will be asked to perform.

Large databases (pupil records) and heavy financial applications (accounting and bookkeeping) require a powerful computer system. Generally, some type of IBM-PC compatible computer system would be the best investment for most schools and school districts. These types of computers have the largest collection of software from which to choose.

Some administrators fear purchasing an "off-brand" computer system because the company may go out of business. But as long as the computer is PC compatible and meets FCC standards (a lot of machines manufactured in foreign countries do not), almost any good repair facility can work on the computer. The insides of PC compatible computers are very similar. Price, availability of service, support, and warranty are the primary considerations when purchasing microcomputer systems.

Remember to inquire about manufacturer educational discounts. Many corporations frequently give a 20% educational discount on all hardware and software. Also, investigate the possibility of purchasing the computer system through mail-order houses. These operations sometimes sell computer systems at 8% to 10% above cost and make their profits in volume. By looking through a few computer magazines, users can find hundreds of mail-order companies willing to do business with school districts.

Getting Started

The first consideration is money. How much is the school district willing to spend to computerize administrative tasks? Expect to spend from $5,000 to $7,000 to computerize fully the administrative functions of a large school. This figure includes hardware, software, and some consultant help. If the money is not available to purchase the needed software and hardware, do not buy cheaper products. Lesser products probably will not meet the administrative needs of the school. Wait until sufficient funds are available.

Administrators also must take into account the physical preparations for the arrival of the new computer system. If special furniture or alterations to the office are needed, have them purchased or performed before the computer arrives. It is useless to have expensive computers sitting in a box for two months because someone forgot to order the furniture, anti-static carpet, or new electrical outlets for the computer area. Also, remember that the warranty is slowly ticking away while the computer waits in its box.

Consultants

If the administrator does not have the necessary background to begin the computerization process unassisted, then some type of help will have to be found. If the school or district has an "in-house" expert, by all means use this individual's skills and knowledge. But be

careful; do not use the skill of someone whose expertise is solely in the curricular applications of 8-bit machines. While these individuals may have a great deal of experience in curricular matters, their shortcomings in administrative processes may be costly.

The average school administrator may need to hire an outside consultant in the initial stages of administrative computerization. There are several requirements that must be met by an external consultant. First, the consultant must be knowledgeable about more than one brand of microcomputer. One of the consultant's primary jobs is to help decide on a hardware configuration that will meet the school's needs. With limited knowledge of available hardware, the consultant cannot respond to those needs. Second, the consultant must know how to use more than one or two software products for each application. Administrators will want an individual who can provide them with a variety of software options. Third, the consultant must understand what is involved in education administration. Do not rely on someone who is primarily a curricular expert. Fourth, the consultant should be well known and reliable and should have a good record in administrative computer consulting in education institutions. And fifth, the consultant should be able to maintain a comfortable relationship with the school administrator and other school staff. Get to know prospective consultants before hiring one.

Establish Priorities

To begin the computerization process, first decide which administrative tasks will most easily lend themselves to automation. Of course, this decision also must be based on the most pressing needs of the school; but do not start with the most difficult tasks. Most schools find that word processing is the easiest place to begin. Such administrative applications as attendance, scheduling, and pupil-management programs are probably the next step in the automation process. Accounting programs will be relatively easy to use by an experienced bookkeeper or clerk; therefore, computerized financial practices would be a good third step in the process. The last task to be implemented is stand-alone relational databases. The complexity of these programs

will confuse the beginning computer user. Allow the school staff to become comfortable with computers and develop their computer skills before implementing relational databases using stand-alone products.

After deciding which administrative tasks are to be computerized, determine which software will do the job. Only after this has been accomplished should one consider purchasing specific hardware. Remember to purchase hardware that is totally compatible with the software chosen. Sophisticated software that will not run on the hardware purchased creates frustration.

Staff Training

There is a good chance that some of the staff will express anxiety about using computers. By pointing out how much easier their jobs will become as a result of computerization, some of the anxiety may be reduced. Also, sending secretaries and clerks to a course or seminar for preliminary exposure to computers will make them much more comfortable with the new technology.

Most areas of the country have local computer workshops or institutions that offer one- to four-week courses in computer use. Such courses should be paid for by the school district, and personnel should be provided time during work hours to take such courses. Also, administrators who take such courses present themselves as good role models to the rest of their staff.

The administrator may wish to use personnel who have attended computer seminars to train the other personnel who will use the computer. In some instances, the rest of the staff will have to be trained by outside personnel. In either case, it is important that the administrator realizes that some type of training will be required. It is also important for administrators to realize that learning to use a computer system is a process that takes months, not days. Do not expect the staff to master the computer instantly.

Transferring to a Computerized System

Resist the temptation to rush the process of converting from a manual system to a computerized one. Just the process of re-typing data

into the computer may take from several months to a year. Do not try to shift everything to computers at once.

Even when working with expensive external consultants, do not trust the computer system completely. Run a manual system along with the computerized one for about six months to determine the accuracy of the computer's operations and the staff's ability to provide correct data entry. The people who write the programs, those who set up the database design, and those who enter data often make mistakes. Before shifting exclusively to a computerized system, check it against a manual system for a reasonable period of time. The administrator who relies solely on the computer for attendance data may find out in June that the computer was reporting wrong attendance figures and there is no manual system on which to fall back.

Once again, the authors of this fastback cannot stress enough the importance of patience in moving to computerized administrative tasks. To develop priorities, to train the staff, and to run a manual system alongside the computer system is the only reasonable approach to this process. If followed, this approach will save numerous headaches and frustrations in the long run, and it will ensure that the administrative tasks of the school are efficiently and effectively automated. Happy computing!

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